STRATEGY RESEARCH PROJECT

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FRESHWATER SCARCITY IN THE NILE RIVER BASIN

BY

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ABSTRACT

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According to a growing body of literature, scarcity of freshwater to meet the many needs of Third World countries is rapidly escalating. Furthermore, many of the remaining exploitable sources of freshwater are in river basins shared by two or more sovereign states. These facts present the potential for violent conflict over water unless affected states can develop and use their common water resources in a cooperative, sustainable, and equitable manner. The United States, in its National Security Strategy and Foreign Affairs Policy, has called attention to the problem of resource scarcity as having important implications for American security. However, the linkages between environment and security are frequently indirect and difficult to identify much less resolve. This paper examines the complex issues associated with freshwater scarcity in the Third World, in particular, the Nile River Basin; the present U.S. policies and diplomatic agenda for dealing with this dire situation; and suggests some possible ways to improve U.S. engagement efforts to remedy this pressing security problem.

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> First of all, my son, see to it you are always positioned upstream... and your enemies downstream.
>
> —Old American Indian proverb

According to a growing body of literature, scarcity of freshwater to meet the many needs of Third World countries is rapidly escalating. Furthermore, many of the remaining exploitable sources of freshwater are in river basins shared by two or more sovereign states. These facts present the potential for violent conflict over water unless affected states can develop and use their common water resources in a cooperative, sustainable, and equitable manner. The United States, in its National Security Strategy, has called attention to the problem of resource scarcity as having important implications for American security. However, the linkages between environment and security are frequently indirect and difficult to identify much less resolve. This paper will examine the complex issues associated with freshwater scarcity in the Third World, in particular, the Nile River Basin, the present U.S. policies and diplomatic agenda for dealing with this dire situation, and suggest some possible ways to improve U.S. engagement efforts to this environmental problem.

WATER: A SCARCE RESOURCE

Of all the natural resources, water is the most essential. It is fundamental to all vital processes of value to life and yet it is in limited supply and unevenly distributed in time and space around the globe. While water seems abundant, covering almost 70 percent of the earth's surface, as much as two thirds of the world's population could be experiencing water stress conditions by 2025.[1] Although water is abundant in many places, only freshwater, accounting for 2.5 percent of the planet's water, is usable for human needs.[2] Unfortunately, most freshwater is in forms that must be regarded as unrenewable on a human time scale. Groundwater, having a lifecycle of several thousand years, and permanent ice and snow comprise the vast majority of this resource. The renewable component, runoff, represents only 0.3 percent of all available freshwater and yet it is more than enough to address human needs, at least on a global scale. However, not all runoff is useable and, as stated above, water supply is irregularly spread over space and time. For a commodity that is required in basically constant quantities, water supply scarcity seems to set absolute limits to human use.

The basic uses of freshwater can be divided into domestic, agricultural, and industrial sectors. Table 1 compares water usage on a regional basis in terms of cubic meters withdrawn per person per year.[3] One should note that Africa, because of availability, consumes the least water of any region in the world.

	Domestic Use	Agricultural Use	Industrial Use
World	52	444	148
Africa	***17***	***216***	***12***
Asia	31	446	42
North / Central America	167	912	782
South America	86	282	110
Europe	92	235	385
Former USSR	90	832	346

TABLE 1. WATER USAGE ON REGIONAL BASIS (M^3/YEAR)

Population growth and geographic distribution are directly related to increased demand of freshwater for domestic uses. Urbanization, through increased population density and concentration of demand, particularly affects local resources. If urban growth is the result of migration of rural poor rather than economic growth, the problems are especially acute. According to the World Health Organization, human beings need about 30 liters of water person per day (11 cubic meters per year (m^3/year)) for good health and cleanliness.[4] Of this amount, only 5 liters is for cooking and drinking. The United Nations estimates that the worldwide average withdrawal from freshwater resources, regardless of the quality, is 52 m^3/year per person. By comparison, Africa withdraws only 17 m^3/year for domestic uses, the least of any region in the world. While freshwater withdrawals for domestic use accounts for only an estimated 11 percent of the total, this component has doubled over the past two decades, mainly because of population growth in third world cities.[5]

Agriculture is the major water user worldwide, accounting for nearly 70 percent of total freshwater withdrawals. Irrigation is vitally important to food production, particularly in regions where populations are rapidly growing. However, because crops require and transpire enormous quantities of water per unit of food produced, water is again the major limiting factor for world agricultural production. Africa's freshwater withdrawals for agricultural use are less than half the world average, 216 m^3/year versus 444 m^3/year. There is a direct relationship between population growth and the need for additional irrigated land. Demand for agricultural products increase with growing population. This in turn requires increased irrigated land and growing need for freshwater supplies. The projected growth of water use for agriculture over the next decade is slow compared to domestic growth, about 1 percent annually worldwide. However, the quantities to be withdrawn are staggering in absolute terms, about twice the additional domestic requirements, and about the same as those projected for industrial needs.[6] As mentioned previously, even in regions where land resources remain for developing the water available for irrigation is still the limiting factor. The competition between sectors in regions with limited water resources will likely be severe, as we shall see when we examine the Nile River basin.

The final sector of basic freshwater use is industrial production. This rapidly growing category is fueled less by population growth than economic growth and development. On a regional basis, the world average of freshwater withdrawal for industrial needs is 148 m^3/year per person. Africa withdraws only 12 m^3/year for its industrial needs. Projections suggest that the fastest growth of this sector's requirements will occur in third world regions like Africa. At any rate, water demand patterns will be characterized by increased competition between the water usage sectors, especially in developing countries.

Human populations impact the water supply in direct and indirect ways. Through a number of activities, humans affect the level of river runoff. Direct withdrawal and changing land use alter the watershed dynamics. This in turn affects the soil water content, recharge rate of aquifers and rivers, freshwater quality and overall availability of this vital resource. A dramatic example of human impact is deforestation. In developing countries where the need for more range- and farmland and wood grows with every birth, forests are plundered with little thought for the consequences. In Ethiopia, only 6 percent of its forest cover remains. Topsoil erodes into the rivers at the rate of 2000 tons per square kilometer every year.[7] Over grazing and overexploitation have similar affects on the soil which results in reduced water quality and availability. Urbanization also affects the dynamics of runoff by replacing permeable soils with impermeable pavements thus reducing the base flow of rivers during dry periods.

In addition to surface water, groundwater serves as an important water supply particularly when surface sources are scarce. Over pumping to help meet the needs of irrigation development and urban growth has contributed to problems such as soil subsidence, aquifer saltwater intrusion. As already mentioned, this source of freshwater is considered unrenewable on a human time scale. Human activities also pollute surface and ground water supplies through a number of means further reducing the quantities of useable freshwater. Each of the sectors of water usage returns some portion of what was originally withdrawn to the water cycle. The table below summarizes this data, as estimated by the United Nations Population Division.[8]

	Portion of Water Originally Withdrawn that is Returned to the Water Cycle	Percentage of Total Wastewater
Domestic Usage	42 %	11 %
Agricultural Usage	25 %	42 %
Industrial Usage	87 %	47 %

TABLE 2. CONTRIBUTIONS OF WASTE TO THE WATER CYCLE

Although a significant portion of domestic water is returned to the water cycle, on average, very little of this sewage is treated, particularly in developing countries. Rapid urban expansion causes great problems in collecting and treating solid and liquid waste. Industry returns most of the water it uses to the

water cycle. Unfortunately, chemicals and heavy metals often pollute it, and the temperature is often unfavorable to the continued well being of the environment downstream. While domestic and industrial sewage are the main sources of pollution in developed countries, agriculture is the biggest contributor to pollution in developing countries. Increases in fertilizer and pesticide use, together with the erosion and leaching that result from deforestation, heavily pollute irrigation returns and runoff. According to the United Nations report, "Overall, the greater part of water pollution is due to growing populations: the direct effect of the search for protein and livelihoods, and the side effects of agriculture and urbanization."[9]

The health considerations of scarce water are immense. Four out of five deaths in developing countries are due to water related diseases such as malaria, cholera, yellow fever, and diarrhea.[10] As the demand for water increases with the population explosion, these problems will only grow larger. Perhaps one can understand why there is little motivation for family planning when 35,000 children die each day in the developing world due to lack of safe drinking water and adequate sanitation facilities.[11] Furthermore, as the demand for water intensifies due to fast-growing populations, the absolute poverty endured by the "bottom billion" is reinforced, since sick people are far less able to grow food and otherwise support themselves.[12]

From the discussion above, one can see that water scarcity impacts human activities on a variety of levels. Competition for water affects the health, hygiene, and physical wellbeing of living things. Water scarcity also limits economic performance. Agriculture and food production relies on irrigation. Industry has similarly intense demands. Depending on the particular situation, urban and industrial needs may be met at the expense of regional agricultural users. By the same token, agricultural consumption may force industry and urban areas downstream to want for water. What remains is to some how try and understand quantitatively the effects and levels of competition for water. To this end there is a widely used model based on the concept of population pressure per flow unit (P/FU), where a flow unit (FU) equals 1 million cubic meters. The model forecasts water scarcity based on population projections and water supply estimates. Table 3. Describes the levels of competition based on scarcity. When applied to global data forecasts for the year 2025, the model projects 15 countries would suffer water stress, 9 would suffer water scarcity, and 22 countries would meet the water barrier.[13] Looking specifically at Africa, Table 4 classifies countries by level of water competition and technological level of cultivation needed to ensure food self-sufficiency in 2025.[14] Countries of the Nile River basin have been highlighted.

Level of Water Competition (P/FU)	Description
No Stress (<599)	Population pressures are not considered a serious issue; water quality problems and dry season supply problems may occur.
Water Stress (600-999)	Chances of more recurrent quantitative or/and qualitative supply problems increase notably
Water Scarcity (1000-1999)	Problems are common and affect human and economic development
Water Barrier (2000)	Maximum population pressure that can be handled in the present state of technology and management capabilities

TABLE 3. STAGES OF WATER SCARCITY (P/FU)[15]

Competition (P/FU)	Technology for self-sufficiency			
	Low level	Intermediate level	High level enough	High level not enough
<100	Cameroon Central African Republic Congo Equatorial Guinea Gabon Guinea Guinea-Bissau Liberia	Sierra Leone		
100-600	Angola Chad Cote-d'Ivoire ***Democratic Republic of the Congo*** Zambia	Botswana Ghana Mali ***Sudan***	Mauritania Namibia Niger Senegal	
Water Stress (600-1000)		Benin Burkina Faso Gambia Mozambique	***Ethiopia*** ***Uganda***	
Water Scarcity (1000-2000)		***Tanzania*** Togo Zimbabwe	Nigeria	Algeria ***Egypt*** Lesotho Libya Morocco Somalia
Water Barrier (>2000)		Malawi		***Burundi*** ***Kenya*** ***Rwanda*** ***Eritrea*** Tunisia

TABLE 4. COUNTRIES OF AFRICA CLASSIFIED BY LEVEL OF WATER COMPETITION AND LEVEL OF AGRICULTURAL INTENSIFICATION NEEDED IN 2025 FOR SELF-SUFFICIENCY

Up to this point, I have provided evidence that freshwater is indeed a scarce resource, particularly in Africa and the Nile River basin. So what?

SECURITY IMPLICATIONS

There has been considerable research into factors linking environmental scarcity to violent conflict. According to Thomas Homer-Dixon, a leader in this field of study, scarcities of renewable resources such as freshwater can produce civil violence and instability, under certain circumstances.[16] However, the link is often indirect. Resource scarcity generates the social effects, such as poverty and migration that are interpreted as conflict's immediate causes. Homer-Dixon goes on to point out that environmental scarcity often encourages powerful groups to capture valuable resources and prompts marginal groups to migrate to ecologically sensitive areas. These two processes reinforce environmental scarcity and raise the potential for further social instability. Without successful social and economic adaptation, economic development can be constrained. Migration naturally follows. Furthermore, the existing distinctions among social groups intensify while government institutions and states weaken. Homer-Dixon concludes this portion of his analysis by stating that the social effects of environmental scarcity, to include constrained economic productivity, population movements, social segmentation and weakening institutions and states, can in turn cause ethnic conflict, insurgencies, and coups d'etat. It is these conflicts linked to environmental scarcity that can have significant indirect effects on the international community. The irony is that the very process that is supposed to lead to a more prosperous peaceful world–economic growth and industrialism under liberal market systems–is the one that is the major cause of environmental insecurity. The effects of environmental insecurity can be direct as well. Homer-Dixon describes four theoretical cases that can result from the inability of a state to deal with resource scarcity: civil conflict; civil conflict leading to international conflict; international conflict with little or no intervening civil conflict, or international cooperation.[17] While international involvement must be measured using suitability, feasibility, and acceptability criteria, cooperation is arguably the most productive solution.

There is another aspect of resource scarcity that considerably complicates the issues. There are 214 river basins around the world shared by two or more nations. A highly disproportionate number of them, 57, are in Africa. If one accepts the premise that multilateral conflicts are considerably more difficult to understand and resolve than bilateral conflicts, then of great concern is the number of river basins shared by more than two countries. Here again, Africa has the preponderance of these extensively shared river basins. At the top of that list, the Nile and the Niger Rivers flow through 10 countries, the Zaire River flows through 9 countries, and the Zambezi flows through 8 countries. Difficulties arise when one country does something or fails to do something in relation to its natural resources that can have serious consequences in other countries. Despite more than 300 treaties dealing with international water resources and more than 3000 treaties with provisions relating to water, coordinated and integrated management of international river basins is extremely rare, especially for the

third world.[18] The cases depicted by Homer-Dixon are easy to imagine when one considers that scarce water is always a terrain security issue, since all concerned parties feel compelled to control the ground on or under which water flows. There is little evidence that suggests nations give up their water rights out of consideration for the wellbeing of neighbors in the region. Not surprisingly, states pursue a very self-centered agenda when dealing with water scarcity issues that have the potential to undermine development and incite instability. How then do affected states interact constructively on issues surrounding water scarcity when the solutions require cooperation and coordination?

Even more delicate is the question of why some states would even care to become involved. Concerned states must beware of interventionism. Nevertheless, evidence of why developed nations should be concerned with water shortages that are located mainly in developing nations can be seen with the United States balance of trade. The United States' hope for expanding its exports lies with developing countries. This year the developing world will account for 50 percent of United States total exports, up 10 percent in the past decade. Markets in developing countries depend on capacity for continued economic growth which, in turn, depends in large measure upon the environmental resource base.[19] Former-Secretary of State George Schultz once said, "There can be no enduring economic prosperity for the United States without sustained economic growth in the Third World. Security and peace for Americans are contingent upon stability and peace in the developing world."[20] The developed world does indeed have a decisive stake in the wellbeing of the developing world. This notion is understood and embedded in U.S. policy, as we shall see in the next section.

RELEVANT PORTIONS OF THE UNITED STATES SECURITY STRATEGY

As a result of globalization, issues and events that have previously seemed quite distant increasingly affect the United States. Given the previous discussion about environmental security, it would be useful to examine the extent to which our National Security Strategy (NSS) deals with these timely issues. While environmental issues have been an explicit part of the NSS since 1991, for the purposes of this paper, I will be using the latest version of the National Security Strategy, which is in draft revision. Former-Secretary of Defense William Perry coined the term, preventive defense. In Dr. Perry's words, with preventive defense, we can "promote trust, stability, and democratic reform, and so help to prevent the conditions for conflict and build the conditions for peace."[21] This novel concept now serves as a key tool in shaping the international environment under the guise of preventive diplomacy. Helping prevent nations from failing is far more effective than rebuilding them after an internal crisis.[22]

Among our national interests is a category derived from our national values. The NSS explicitly addresses the important implications for American security of resource depletion, and the related concerns of rapid population growth and mass migration, well beyond our national boundaries.[23] For the first time, the NSS acknowledges the dire importance and ramification of natural resource scarcity. "Decisions today regarding...natural resources can affect our security for generations.... Natural resource scarcities can trigger and exacerbate conflict."[24] In this context the connection between national security

and environmental security is straightforward. The document describes in broad terms United States' efforts to avert conflict through diplomacy, in cooperation with other governments, international institutions, and non-governmental organizations. It goes on to say that we seek to undertake initiatives that minimize environmental and health threats thereby shaping the international environment. We provide foreign assistance to improve protection of the environment and natural resources. We strive to reduce the need for costly interventions by actively pursuing sustainable development programs and leveraging scientific and technological programs. The NSS further says we are safeguarding the environment by promoting a range of World Bank and regional development bank reforms and that we advocate environmentally sound private investment and responsible approaches by international lenders. And though the document goes on the say we have a full diplomatic agenda to respond to our environmental concerns, are we doing enough?

In the current International Affairs Strategic Plan (IASP) published by the State Department, Madeleine Albright sets outs the comprehensive vision of United States national interests compatible and consistent with the National Security Strategy. The IASP's central premise is that successful conduct of international affairs constitutes America's first line of defense.[25] The first strategic goal cited in the IASP deals with regional stability. The strategies call for using preventive defense and conflict resolution to prevent, manage, and resolve crisis, as well as, addressing the root causes of conflict both multilaterally and bilaterally, using development assistance. Further down the list is the goal promoting economic development. Embedded here are the United States attempts to promote agricultural development and improve agricultural production, as well as alleviate poverty and increase economic opportunities for the poor through programs aimed at small enterprise. The strategic goals covering the environment, population, and health are at the end of the list. Perhaps this is a case of where the best has indeed been saved for last. The IASP cites the availability and purity of fresh water as an indicator of global environmental degradation, which if not addressed will have an increasingly negative impact on security, prosperity, and health. The strategies indicated for addressing the impact of environmental concerns on the United States include the use of development assistance to improve the capabilities of developing countries to reduce environmental degradation. The United States seeks to promote regional cooperation on transboundary environmental issues and improve coordination between international financial institutions, the scientific community, and countries needing assistance.

While the IASP refers frequently to regional stability, goals and strategies below the global level are left to other means, which we will discuss in a moment. Returning to the National Security Strategy, there are sections dedicated to regional specific comments. In the portion covering Africa, the NSS discusses promoting regional stability through engagement with sub-regional organizations and key African states using carefully harmonized U.S. programs and initiatives. Although there has been recent progress to address the needs of the malnourished and improve diversified agricultural production, the section acknowledges the need to do more to help Africa generate the food and income needed to feed themselves and promote sustainable growth and development.[26]

In 1997, Madeleine Albright, the Secretary of State, released her first Annual Report on Environmental Diplomacy: The Environment and U.S. Foreign Policy. Scarcity of water was not among the 5 global challenges addressed; however, water resource issues were discussed subsequently under regional priorities. Included in the report was the promise to create regional environmental hubs to tackle the priority environmental problems specific to each region. Jonathan Margolis, Senior Advisor for Regional Policy Initiatives, Department of State, clarifies the State Department's perspective, "By their nature these transboundary issues [such as competition for scarce water] involve multiple actors in a single region, and there is no clearly defined mechanism or institution to address these problems."[27] He adds that the State Department's role is to raise environmental issues and work towards solutions in the foreign affairs community. The State Department's goal is to assist other governments, especially in the developing world, balance their competing interests and convince them that economic growth and sustainable development are not mutually exclusive. This is where the regional environmental hubs come into play. The objectives of these hubs are to promote U.S. Foreign Policy, provide information flow, participate in regional cooperation initiatives, and serve as the U.S. government point of contact for regional environmental issues. These hubs also serve to focus the funding and priority of environmental operations aimed at the long-term economic stability and growth of the various regions.

To this point, we have established the fact that freshwater is a scarce resource and that conflict is often linked to the competition for scarce resources. We have noted that United States' National Security Strategy and Foreign Policy acknowledge this and address water scarcity concerns through regional initiatives. By examining the Nile River Basin, one can see specifically how all the aspects of water scarcity are manifested and dealt with in a particular region.

NILE RIVER BASIN CASE STUDY

In the northeast corner of the Africa, encompassing over 1 million square miles or 1/10 of the continent's landmass, lies a region that is ecologically diverse, yet tenuously bound together by a common feature–the Nile River. This vast drainage basin stretches for 4,000 miles through varied topography and several sovereign states. This region has seen a great deal of ethnic conflict, famine, and civil war. State governments in the basin have struggled, largely unsuccessfully, to sustain development and address the poverty of the region. The connection between the river and the region's troubles deserves closer examination.

Besides the Nile River itself, water sources consist of the aquifers under the basin that are recharged by the river only. Reduction in river flow may substantially degrade these underground water reserves. However, with proper recharge, up to 1 billion cubic meters of water may be used annually to support needs in Egypt, Ethiopia and Sudan.[28] This source is critical when one considers that half of the river's flow evaporates or transpires. Furthermore, global climatic changes are projected to exacerbate this problem by as much as 25 percent in the future by substantially altering the established pattern of precipitation and evaporation in the basin.[29] The water available in the Nile basin for domestic, agricultural, and industrial use is finite, at best, and declining at worst.

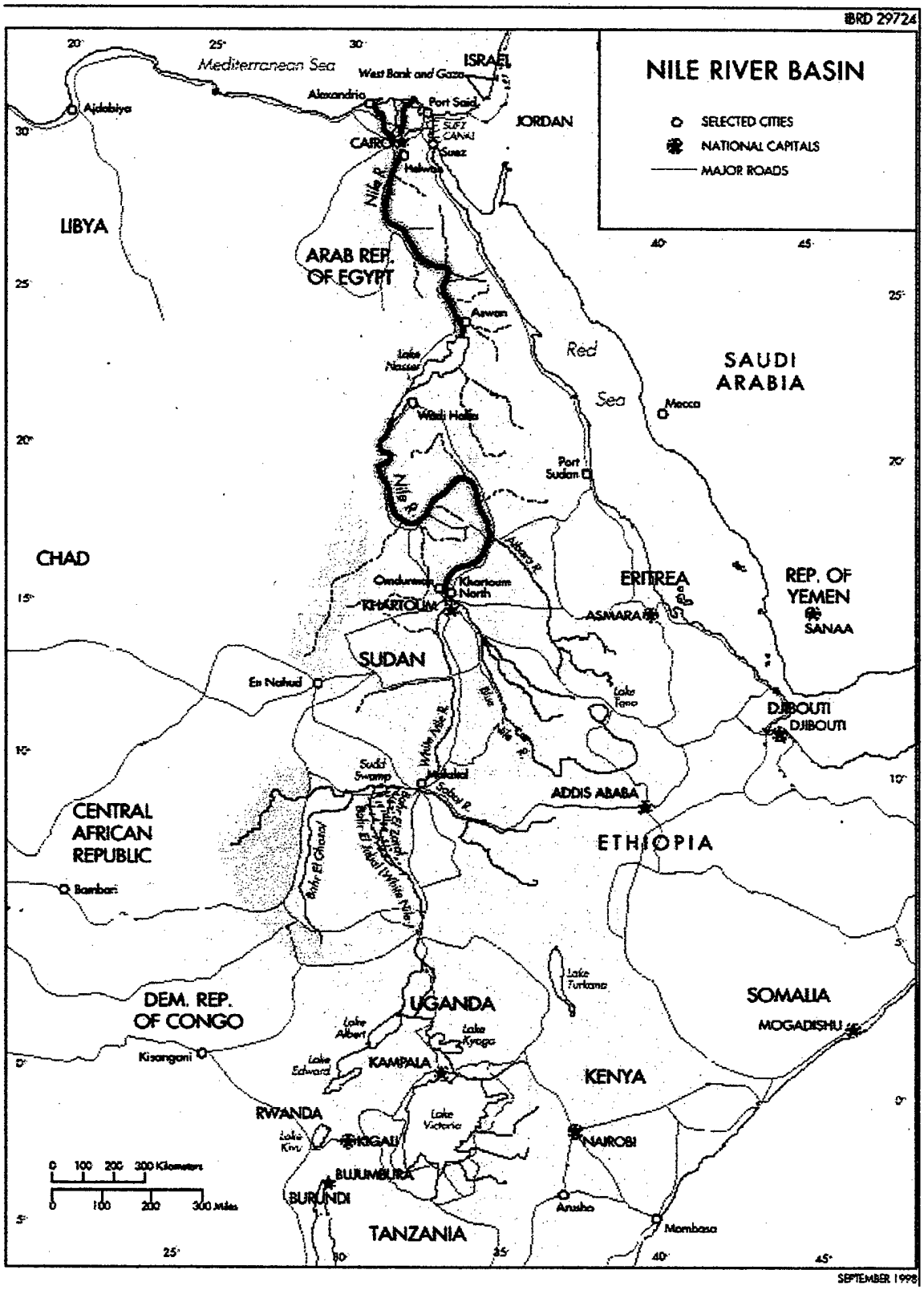

FIGURE 1. NILE RIVER BASIN

One cannot appreciate the freshwater scarcity issue in the Nile basin without understanding the magnitude of population growth and rapid urbanization. The following Table reflects some of the basic indicators for the region by country.[30]

	Population Year 1999 (million)	Population Growth Rate (%)	Projected Population Year 2025	GDP 1998 ($ billion)	GDP Per-Capita ($ US)	Foreign Debt 1998 ($ billion)
Egypt	67	2.2		188	2,850	28
Sudan	35	2.7	57	31	930	21
Ethiopia	60	3.0	140	33	560	10
Eritrea	4	3.9	6.5	2.5	660	1
Uganda	23	2.8	50	23	1,020	3
Rwanda	8	2.4	13	5.5	690	1.5
Burundi	6	3.5	12	4	740	1.5
Kenya	29	2.6	62	44	1,550	6
Tanzania	31	2.9	78	22	730	8
Democratic Republic of the Congo	50	3	106	35	710	15

TABLE 5. NILE BASIN RIPARIANS: SELECTED BASIC INDICATORS

In 1999, the combined population of the Nile basin was close to 315 million people. With growth rates in the region as high as 3.9 percent, this number could rise to over 500 million people by 2025. Since most of the land that can be farmed is already being farmed, the population growth will be most dramatic in urban centers. Table 6 below shows just how dramatically the availability of water drops in the Nile basin due solely to projected population increases and current rates of extraction.[31] In very simple terms, the water scarcity problem in this region impacts the ability of the population to feed itself. Unfortunately, the World Bank estimates agriculture production will grow at most only 2.5 percent per year over the next two decades while population growth remains closer to 3 percent. This is cause for concern.

	1990	2025
Egypt	1070	620
Ethiopia	2360	980
Kenya	590	190
Rwanda	880	350
Tanzania	2780	900

TABLE 6. ANNUAL PER CAPITA WATER AVAILABILITY (M3)

The previous figures reinforce the truth that each country of the Nile River basin will experience some level of water competition by the year 2025. The problem is further compounded since limited resources in the basin are suffering environmental damage and degradation due to a number of factors. Deforestation in Ethiopia leads to topsoil erosion and silting of river channels. In Uganda, toxic chemicals being used to eradicate the massive spread of hyacinth and other waterweeds leach back into the water supply. Throughout the region, improper irrigation techniques contribute to excessive evaporation and soil salinization. Slow moving waters create favorable conditions for spreading numerous waterborne diseases, such as bilharzia, the energy sapping sickness transmitted by snail larvae. Land is also a factor in the water scarcity equation. For example, despite massive extension of perennial irrigation for almost a century, arable land per person in Egypt declined from 0.5 acres in 1900 to 0.15 acres in 1990 while the population rose from 10 million to 52 million.[32] Urban encroachment on precious arable lands, as well as salinization and the heavy use of chemicals have greatly reduced availability of agricultural land in the basin, particularly in Egypt and Sudan. With approximately 93 percent of the labor force involved in either subsistence agriculture or raising cattle, technological improvements are necessary to address the shortfall of food production. Unfortunately, the agricultural technology necessary to ensure sufficient food production in the future is questionable in several countries in the region (refer back to Table 4). The need for expanded agricultural productivity requires developing appropriate irrigation and more arable land. Meanwhile, the region grows hungrier in absolute and relative terms. To address this hunger, the region continues to be a net importer of agricultural commodities. Egypt, for example, imports more than 50 percent of its food requirements.

The last component of water consumption is industrial usage. As was stated previously, industry places large demands on water sources as well. According to research hydrologists, 1,000 cubic meters of water per year per capita is the minimum necessary for an efficient, moderately industrialized nation.[33] Given the figures of available water in the Nile basin, it is hard to imagine an economy based on industry without some rather dramatic shifts away from cultural reliance on agriculture.

Notwithstanding the preceding discussion, to truly understand water scarcity in the Nile basin, one must understand and appreciate the "Egypt condition." 96 percent of Egypt's population resides along

the Nile and in the Nile delta, roughly 4 percent of Egypt's landmass. No other comparably populous country in the world has such a narrow and concentrated economic geography that is so dependent on the waters of a shared river. While Egypt is the strongest country in the region, both militarily and economically, it is nevertheless the most vulnerable in terms of water security, depending on 9 other upriver states. Ironically, in 1970, the late Egyptian President Anwar al-Sadat publicly entertained the idea of supplying the Nile's water to Saudi Arabia and to Israel through a pipeline under the Suez Canal and across the Sinai Desert.[34] He, like many others, anticipated surplus water after the Aswan High Dam was constructed. Less than a decade later, following the Camp David peace accords, Sadat is attributed with saying that the only reason Egypt might go to war again with any of its neighbors would be the result of a dispute over water.[35] Clearly, Sadat recognized the vital importance of the Nile's water to Egypt's viability. What he may not have fully appreciated is that the Nile does not exist for Egypt alone.

Certainly history contributed to this misperception. Colonial-era agreements for sharing water resources in the Nile basin stated, "no works or other measures likely to reduce the amount of water reaching Egypt were to be constructed or taken in Sudan or in territories under British administration without prior Egyptian consent."[36] The virtual monopoly over water development Egypt enjoyed broke down when Sudan gained independence and began to exercise autonomy. Other upstream states also refused to accept the terms of colonial agreements.

Nevertheless, Egypt took advantage of its relative power in the region to pursue its own interests. In 1948, a plan called the Century Storage Scheme was formulated by the Egyptian government for developing the Nile's potential to meet the future needs for water and energy in Egypt and Sudan, as well as to provide power to Kenya, Tanzania and Uganda. The Scheme included diverting large amounts of water from the Sudd Swamps and was to produce an additional 18 billion cubic meters of water for the lower two riparians. It was only partially constructed before another more massive project was devised. The Aswan High Dam is the "most recent, and surely not the last manifestation of Egypt's struggle to dominate rather than coexist with the Nile Valley."[37] However the Aswan Dam has been highly criticized for a number of reasons. It hold back silts that rejuvenate soil fertility downstream resulting in intensive fertilization. By providing cheap, abundant supply of irrigation water, it has encouraged over irrigation without proper concern for drainage. The result is water logging due to increased groundwater level and abandonment of farmlands. Project efficiency has been questioned since an estimated 10 billion cubic meters of water has evaporated compared to an increase of only 15 billion cubic meters of water experienced jointly by Egypt and Sudan. The Aswan Dam has given Egypt a false sense of water security and therefore impeded Egypt's cooperation in basin-wide efforts to address regional water issues.

Other plans exist to extend irrigation and develop new cultivated land. Egypt would like to construct new cities in the desert and bring agriculture to millions of acres. The Toshka project is designed to pump 5 billion cubic meters of water a year from Lake Nasser into the Western desert to put some 420,000 hectares of land under cultivation.[38] Contracts were signed in March 1998 to start

construction of pumping stations that would divert excess waters behind the Aswan dam into what has been described as the world's longest canal. The 200-mile long canal would be built in five years and cost nearly $2 billion. President Hosni Mubarak has named it the Sheikh Zaid al-Nahayn Canal, to honor the Emir of Abu Dhabi and recognize the sheikh's aid to earlier irrigation projects. Ethiopia, which claims to contribute over 80 percent of the Nile's water and to use a mere 1 percent, has raised a diplomatic red flag over the project. In northern Egypt, an irrigation project based in part on Sadat's earlier idea has already started bringing water to the Sinai desert. The "Peace Canal" consisting of four 42-meter ducts carries Nile waters under the Suez canal and, when complete, will add over 250,000 hectares of arable land.[39] Most of the $1.7 billion in financing came from the Emir of Kuwait, Sheikh Jaber al-Ahmed Al-Sabah.

The other countries of the Nile basin also have plans to enhance development and agricultural productivity. For example, over the next five years, Ethiopia proposes to construct 7dams along the Blue Nile to more than double its electrical generating capacity and provide a source for irrigation. The question is whether Ethiopia and the others can afford their projects. In most countries the debt problem is overwhelming (see Table 5). Without radical economic restructuring and substantial external assistance, none of the Nile basin countries is in the position to unilaterally undertake any large water project. External support is unlikely unless the projects acceptably address the concerns of all riparian states.

More than just the lack of money, the lack of cooperation and political stability further complicates the complex situation in the region. The Nile basin is not only shared by one of the largest number of riparian states, but also some of the youngest, having only recently acquired independence from colonial rule or as the result of civil war. As one would expect, the initial focus of any new state is on establishing its power base not on sustainable development. Given the level of food production in the region, it should not surprise anyone to know that food is often used as a weapon by governments and insurgents alike, by usurping the domestic and externally provided food supplies and denying them to their opponents.[40] When this occurs, the marginalized sections of rural populations suffer the most and are most likely to follow the paths suggested previously by Mr. Homer-Dixon. It is ironic that one of the largest freshwater basins in the world has so much potential for domestic upheaval and large-scale human suffering as a direct result of freshwater scarcity.

However there are encouraging signs of cooperation among the Nile's riparian states. The countries have met annually since 1993 to foster cooperation, and have agreed to work toward equitable allocation of the Nile waters. Egypt has committed to this effort as seen in their involvement in helping Uganda develop their hydroelectric capacity. Egypt has also begun to normalize its relations with the government of Sudan. In fact, in 1998 a regional council of water ministers made substantial progress towards establishing a comprehensive new Nile Basin organization.[41] This progressive step is remarkable when one considers that the participating countries have ostensibly agreed to relinquish some state sovereignty for potential good of the group. The State Department Regional Environmental Hub for

East Africa is working with the appropriate water ministries, international organizations and financial institutions to continue this positive interaction and open discussion among all countries of the Nile Basin. The United States should build upon this momentum and extend its efforts to engage the region using preventive diplomacy. The following section provides some recommendations on how to proceed.

RECOMMENDATIONS FOR U.S. POLICY / ACTION

The idea that "We're all in it together" suggests the imperative of U.S. positive action. As Richard H. Soloman, President of United States Institute of Peace, has summarized, "The trend is toward multilateralism in making more productive and equitable use of shared rivers' water. The U.S. plays a significant role in applying political pressure and supplying economic and technical support to help developing countries cooperate effectively."[42] While this smacks of interventionism, our support for developing nations is necessary for the stability we seek in the world order. The U.S. must prudently apply its generous financial resources, political acumen, preeminent scientific skills, and technological know-how in leading cooperative efforts to ensure an environmentally secure world. As Thomas Neff points out, "Water is the world's most essential resource. No other substance carries greater potential for conflict or disaster when scarce or poorly distributed, so approaches and concepts and actions must be commensurate with the magnitude of the problem, and where water is concerned, the problem is nothing less than survival."[43] But Neff perceives that because of the complexity of the issues, water scarcity tends to be dealt with piecemeal rather than comprehensively. The U.S. must be careful to avoid this tendency.

Research has shown that domestic and international institutions are extremely important in conflict resolution.[44] Here again, the U.S. can promote cooperation by encouraging and participating in linked and overlapping institutions that support intervention between environmental degradation or depletion and violent conflict. Ideally, these international institutions would help implement negotiated settlements and provide early interventions in disputes. The efforts underway to form a Nile basin organization must continue. The U.S. must act to ensure this basin-wide water authority has sufficient independence and power and expertise and funds to perform the necessary management functions.

Open communication and confidence building is key in this regard. Progress must be made in collecting and sharing water-related data among the riparians. This data is crucial for developing equitable solutions in the region. Cooperation among the riparians is paramount to a stable region. The U.S. should consider debt for cooperation swaps as a powerful tool in developing water-sharing agreements.

One particular set of organizations, those affiliated with the United Nations, has the potential to wield a great deal of influence in resolving water scarcity conflicts. However, the U.S. has shirked its leadership role. The U.S. must regain its credibility by paying its arrears to the UN. When the U.S. fails to act, other nations view our inaction as an excuse to do nothing. The bottom line is that the technical impediments are not as great as the political, economic, and security-related factors.

Clearly, moderating population growth serves at least to alleviate the growth of problems by moderating growth of demand, moderating growth of human waste, and easing the time and space constraints that pressure sound development measures, such as more efficient irrigation and waste disposal. Through diplomacy and technical means, we must continue to develop better understanding by countries in the Nile basin of the relationships between population dynamics, socio-economic development and water.

A much more long-term initiative would be to restructure the state economies away from heavily irrigated agriculture toward other sectors (electronics, services, and industry). This is a politically complex issue. Agriculture is culturally imbedded, highly symbolic, and militarily significant. However, light and service industries contribute far more to the Gross Domestic Product per cubic meter of water consumed than does agriculture.

Certain aspects of the water scarcity dilemma can be addressed more expeditiously through investment and technology. The cost of improving the situation is really quite reasonable. It is estimated that it would cost around $15 billion a year for 10 years to supply the water needs of most of the developing world, mainly through making more efficient use of water stocks.[45] The Nile basin's share would be something less than that. The U.S. would be wise to spend enough foreign aid dollars in the region to prevent future water related conflict. Likewise, the U.S. must lead the way in seeking new environmental technologies and investing heavily in them. These technologies must then be implemented through trade measures to be fully leveraged in the addressing problems facing the Nile states. While there are certainly requirements for large-scale water supply projects, new technologies and water management practices can facilitate more efficient allocation and use of scarce water resources.

If cost seems prohibitive, one bold suggestion is to trade off military security.[46] Take some U.S. defense dollars and apply them to foreign aid. Marginal trade-offs could focus limited financial resources on the higher payoff result of increased agricultural productivity and sustainable development in the Nile basin. This extreme notion gets right to the heart of preventive defense. But if one considers the likely alternative of military intervention and those associated costs, it is money well spent. Besides, "Any realistic review of our ability to maintain military readiness over the long term should include a strategy for limiting the situations in which our troops will be called upon to act."[47]

Each day we hesitate to act makes the ultimate solutions all the more difficult and expensive.

WORD COUNT = 6782

ENDNOTES

[1] Kent H. Butts, ed., Environmental Change and Regional Security (Carlisle Barracks, PA: Center for Strategic Leadership, United States Army War College, September 1997), V-15.

[2] United Nations Population Division, Department of Economic and Social Affairs, Population and Water Resources, September 1994; available from http://www.undp.org/popin/fao/water.html; Internet; accessed 24 January 2000.

[3] Ibid.

[4] Ibid.

[5] Ibid.

[6] Ibid.

[7] Ibid.

[8] Ibid.

[9] Ibid.

[10] Norman Myers, Ultimate Security, The Environmental Basis of Political Stability (New York: W.W. Norton & Company, 1993), 53.

[11] Ibid., 54.

[12] Ibid., 53.

[13] Countries projected to suffer water stress are: Afghanistan, Burkina Faso, Ghana, India, Korea Republic, Lebanon, Lesotho, Madagascar, Mozambique, Peru, Poland, Tanzania, Togo, Uganda, and Zimbabwe. Countries that would suffer water scarcity are Comoros, Cyprus, Egypt, Ethiopia, Haiti, Iran, Morocco, South Africa, and Syria. Countries forecasted to meet a water barrier before 2025 are: Algeria, Bahrain, Barbados, Burundi, Cape Verde, Djibouti, Israel, Jordan, Kenya, Kuwait, Libya, Malawi, Malta, Oman, Qatar, Rwanda, Saudi Arabia, Singapore, Somalia, Tunisia, the United Arab Emirates, and Yemen.

[14] United Nations Population Division, Department of Economic and Social Affairs, Population and Water Resources.

[15] Ibid.

[16] Thomas Homer-Dixon and Jessica Blitt, eds., Ecoviolence: Links Among Environment, Population, and Security (Lanham, MD:Rowman & Littlefield Publishers, 1998), 223.

[17] Butts, IV-6.

[18] Arun P. Elhance, Hydropolitics in the 3rd World, Conflict and Cooperation in International River Basins, (Washington, D.C.: United States Institute of Peace Press, 1999),5.

[19] Myers, 25.

[20] Myers, 26.

[21] Butts, II-9.

[22] NSSR-99 First Draft Consolidated, National Security Strategy (Washington, D.C.: The White House, 1999), 7.

[23] Ibid., 2.

[24] Ibid., 13.

[25] Madeleine K. Albright, United States Strategic Plan for International Affairs (Washington, D.C.: The State Department, February 1999), 7.

[26] NSSR-99 First Draft Consolidated, National Security Strategy, 46.

[27] Geoffrey Dabelko, ed., Environmental Change and Security Project Report (Washington, D.C.: The Woodrow Wilson Center, Spring 1998), 102.

[28] Elhance, 58.

[29] Ibid., 58.

[30] CIA data

[31] Elhance, 59.

[32] Ibid., 60.

[33] Ibid., 59.

[34] Ibid., 53.

[35] Ibid., 53.

[36] Ibid., 69.

[37] Ibid., 74.

[38] Charles H. Cutter, Africa 1999, The World Today Series (Harpers Ferry, WV: Stryker-Post Publications, 1999), 231.

[39] Ibid.

[40] Elhance, 64.

[41] "Issue Spotlight: Regional Environmental Issues and Hub Program," Regional Environmental Hub for East Africa.

[42] Elhance, xi.

[43] John Holdren et al. Environmental Dimensions of Security: Proceeding s from a AAAS Annual Meeting Symposium (Washington, D.C.: American Association for the Advancement of Science, 9 February 1992), 30.

[44] Dabelko, 114-5.

[45] Myers, 54.

[46] Myers, 214.

[47] Eileen Claussen, "Environment and Security: The Challenges of Integration," Spring 1995; available from http://ecsp.si.edu/ecsplib.nsf/406b9ad; Internet; accessed 21 September 1999.

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